Headquarters U.S. Air Force

Integrity - Service - Excellence

Air Force Command and Control ~ The Path Ahead

U.S. AIR FORCE

SAB 2000 Summer Study Outbrief

CSAF 15 Sep 00

SecAF 10 Oct 00

Dr. Pete Worch, Study Chair
USAF Scientific Advisory Board


UNITED STATES AIR FORCE
SCIENTIFIC ADVISORY BOARD

Terms of Reference

- The Air Force is not on a path today that provides coherence across space, air, and land assets to support the most timely and effective decision making and execution
- The Board was asked
  - *to assess the C2 system and the supporting communication and information systems*
  - *to consider technical and process improvements, and to make recommendations on what should be done to "have the USAF linked by 2005"*
  - *to build toward the Air Force's long term command and control goals*

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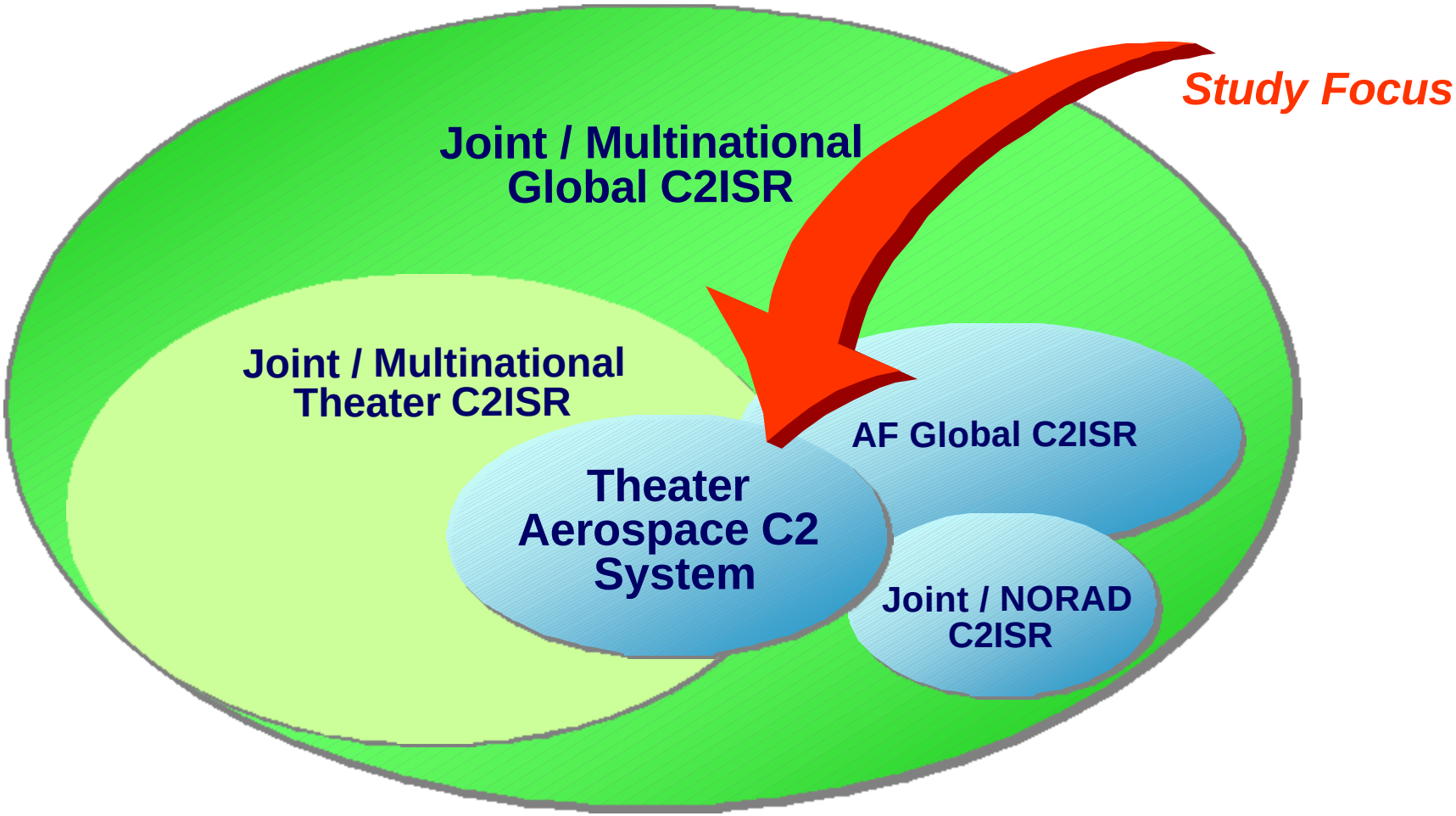
The Study Focus

SAB 2000: Air Force C2~The Path Ahead



Study Tasks

- Define the Air Force command and control system with today's capabilities and identify alternatives to enhance C2 over time (Concept and System Definition Panel - Lt Gen (R) Joe Hurd)
- Define interoperability (joint and coalition) to ensure coordinated efforts on the battlefield (Interoperability Panel - Dr. Mike Borky)
- Identify the technologies that can enhance present and future command and control systems, with near term emphasis on timely and effective communication (Technology Panel - Dr. Alison Brown)
- Assess the acquisition, programmatic and cost effectiveness issue (Acquisition and Program Management Panel - Maj Gen (R) Eric Nelson)
- Consider the organizational, personnel, training and support consequences (People and Organization Panel - Mr. Jeff Erickson)

And we added a Bridging and Vision Panel - Mrs. Natalie Crawford

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AF C2 Activities - What Has Happened?

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- There have been numerous studies and organizations aimed at improved command & control
- There is a general sense that the attempted solutions are acquisition-driven, rather than operation-driven
- Deficiencies have been documented many times--some have existed for many years with little real progress
- "Fix it" plans stack high
- Numerous C2 architectures and CONOPS have been developed
- Senior leadership decided on changes, yet change did not happen
- ***There has been little improvement in the C2 capability***

History - AF C2 Activities

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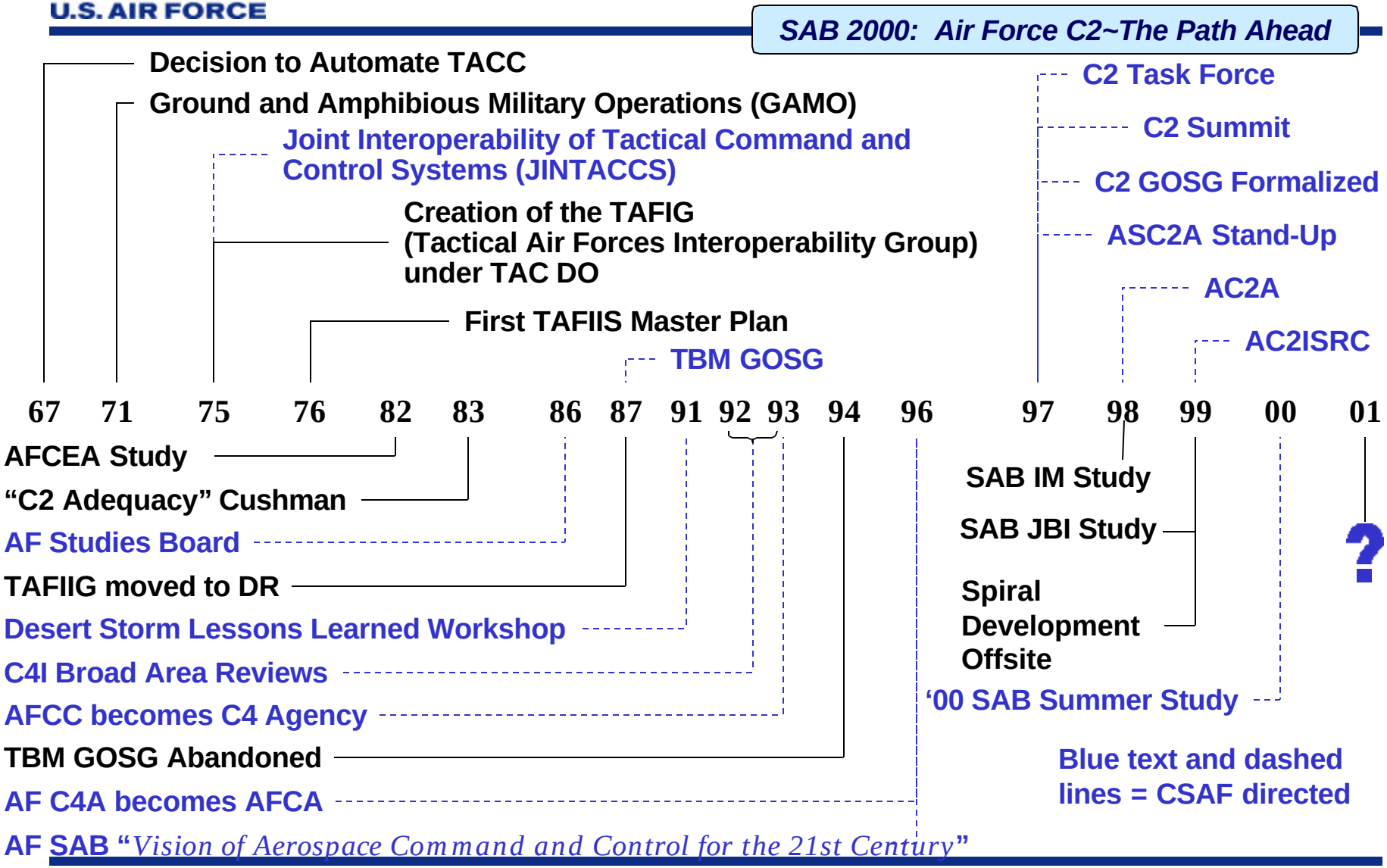

Fundamental Dimensions of the Problem

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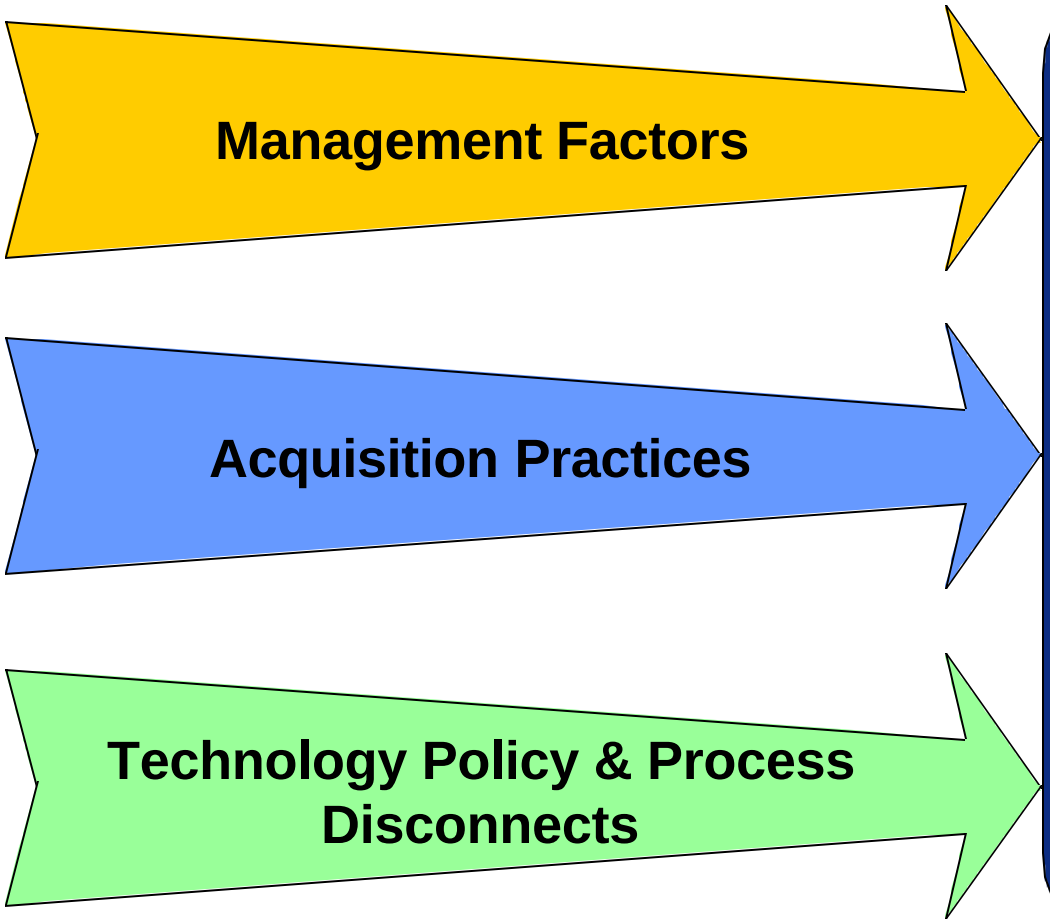

- The Information Age has made the Command & Control function a very complex challenge
- Information technology to enhance Air Force operations abounds
- The C2 capability implementation process cannot keep up with the progress in operational concepts or technological innovations
- The C2 management & budget process is too fragmented to achieve a victory

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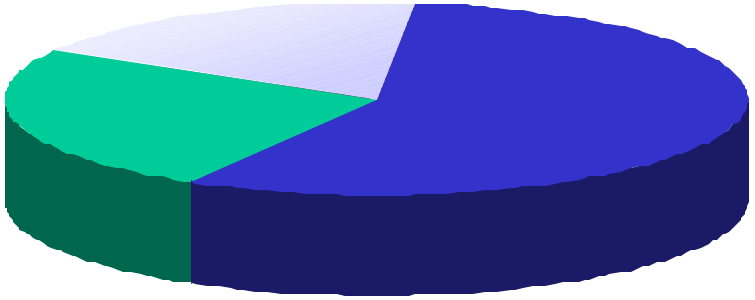
C2ISR Funding
(FY 02 POM)

C2ISR - $10.5B



- C2 O&S $2.6B
- C2 RDA $1.9B
- ISR $5.9B

8 Panels manage the C2 budget

131 Program Elements are involved

26 commands and agencies are affected

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A Framework For Improvement

- A unified, understood, focused approach to C2
- A CONOPS-driven, capabilities-based process that encourages, not impedes, system operational enhancement
- Acquisition processes that are timely & efficient in capturing emerging technologies
- Lead in becoming more interoperable, including joint/coalition
- Horizontal integration of ISR with C2
- Focus and follow-through

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Recommendation: Emphasize Role of Command and Control in the Air Force

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- **Endorse and institutionalize a compelling C2 vision… first step to recognizing the essential link between aerospace power and C2 (AF/CC)**
- **Establish coherent capability-based management for C2 and communications - Place a single manager (e.g., Lt Gen, Operator) at the Air Force level, and include as a member of the Air Force Council (AF/CC)**
- **Hire expert IT and C2 professionals (IPAs?) for key positions in the C2 structure (AQ,XO,SC)**
- **Manage and exercise the Air Force C2 enterprise as an integrated system of "weapon systems" (AQ,XP,XO,SC)**
- **Restructure C2 programs and initiate migration (reduction) to PEs by nodes (weapons systems) and links (AF/XP)**
- **Establish Air Staff proponent for AFFOR C2 processes & systems (AF/CC)**

A Command and Control Vision

The Commander will understand, anticipate, and dominate the battlespace through distributed, collaborative planning and execution within a network of C2 centers/nodes.

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A Possible Logo Change

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Proposed
C2 Program Consolidation

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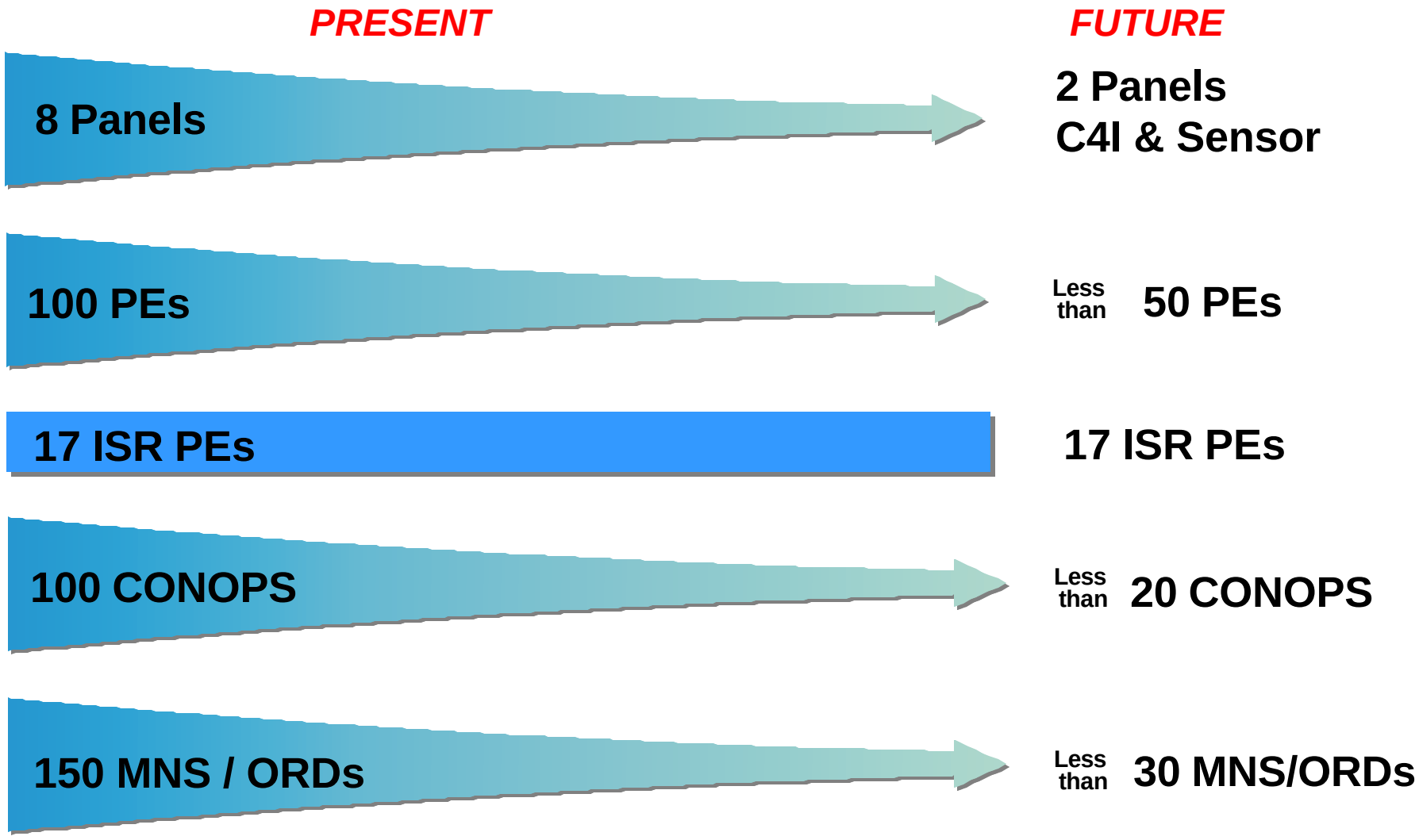

Recommendation: Manage Theater Command & Control As An Integrated Set of Weapon Systems

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- **Designate the C2 nodes (AOC, ASOC, WOC, AWACS, JSTARS, etc.) as weapon systems (XO,SAF/AQ). Assures standardization of**
  - **Equipment**
  - **Processes**
  - **Software**
  - **Manning**
  - **Training,**
  - **Personnel Certification**
- **Create and maintain a capabilities-based Theater C2 Weapon Systems Integration Roadmap and review regularly (XO,SC,AQ). Participants:**
  - **PEOs**
  - **Program Managers**
  - **MAJCOM Requirements Reps**
  - **Air Staff (XP,XO,SC,AQ)**
  - **AC2ISRC**
- **Establish and fund a single C2 integration activity (XO,SC,AQ,AFMC)**

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Theater Aerospace Command and Control System (TACCS)

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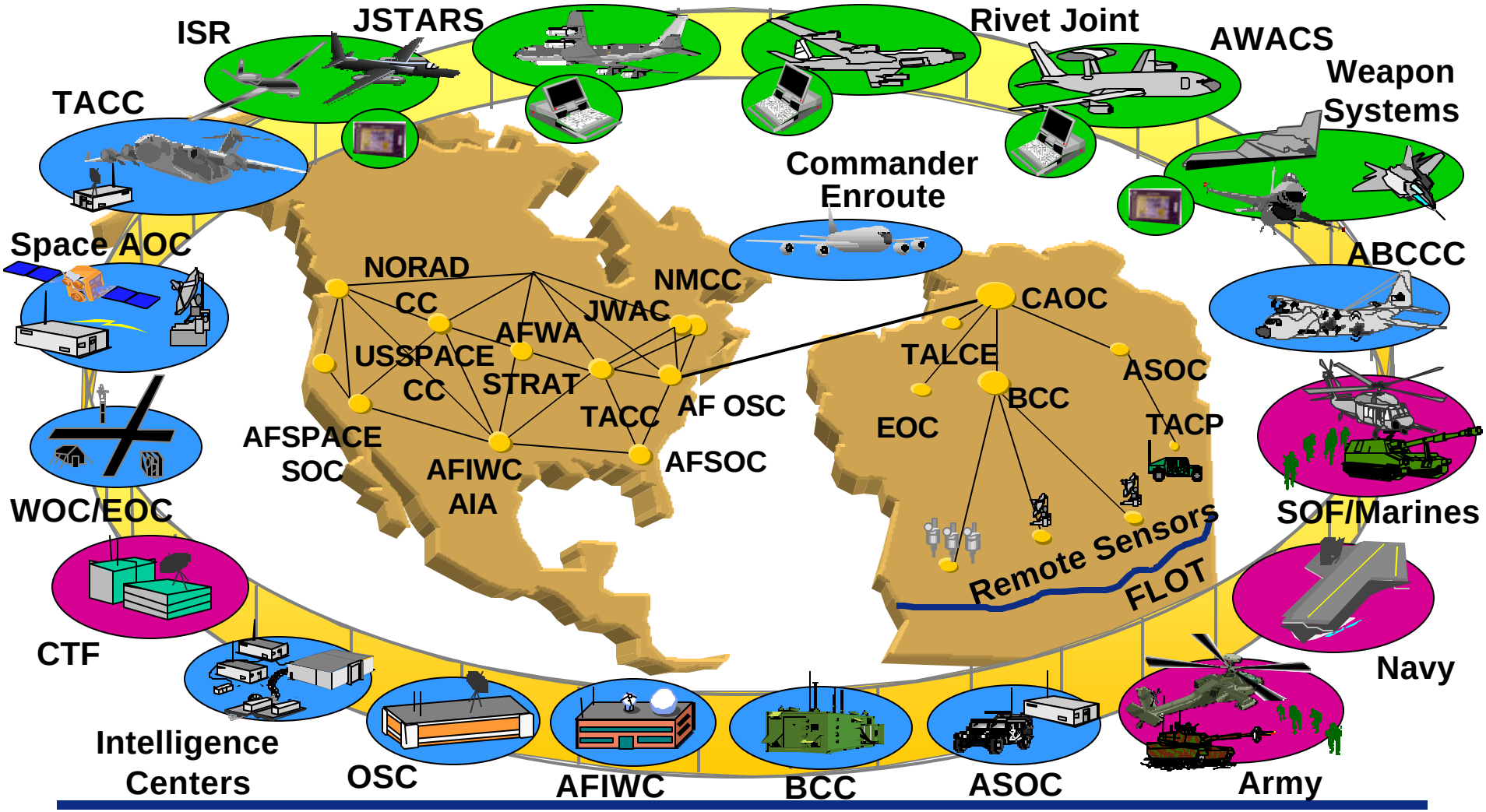

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Recommendation: Strengthen the AOC Through Restructuring, Staffing and Training

- **Manage the AOC as a Weapon System**
- **Restructure the operational headquarters (NAF) based on requirements to support expeditionary operations (XO)**
- **Streamline and enhance AOCs based on:**
  - **Baselining the number and locations**
  - **Standard organization**
  - **Standard processes and systems**
  - **Effectively motivated, trained, and certified personnel**
  - **New technology (TBMCS)**
- **Conduct daily training for C2 Warriors (i.e. 5/12 Ops, daily ATO?)**
- **Conduct Joint training (live/virtual)**

(XO,AQ)

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(XO,AQ)

Train like we are going to fight!

AOC Manning Authorization

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		AOC Personnel		
Sorties/day	**Size**	**Today**	**2001**	**2005**
300-900	Quick Response	441	350	250
900-1800	Limited Response	870	600	400-500
1800-3000	Theater Response	1055	800	600-800

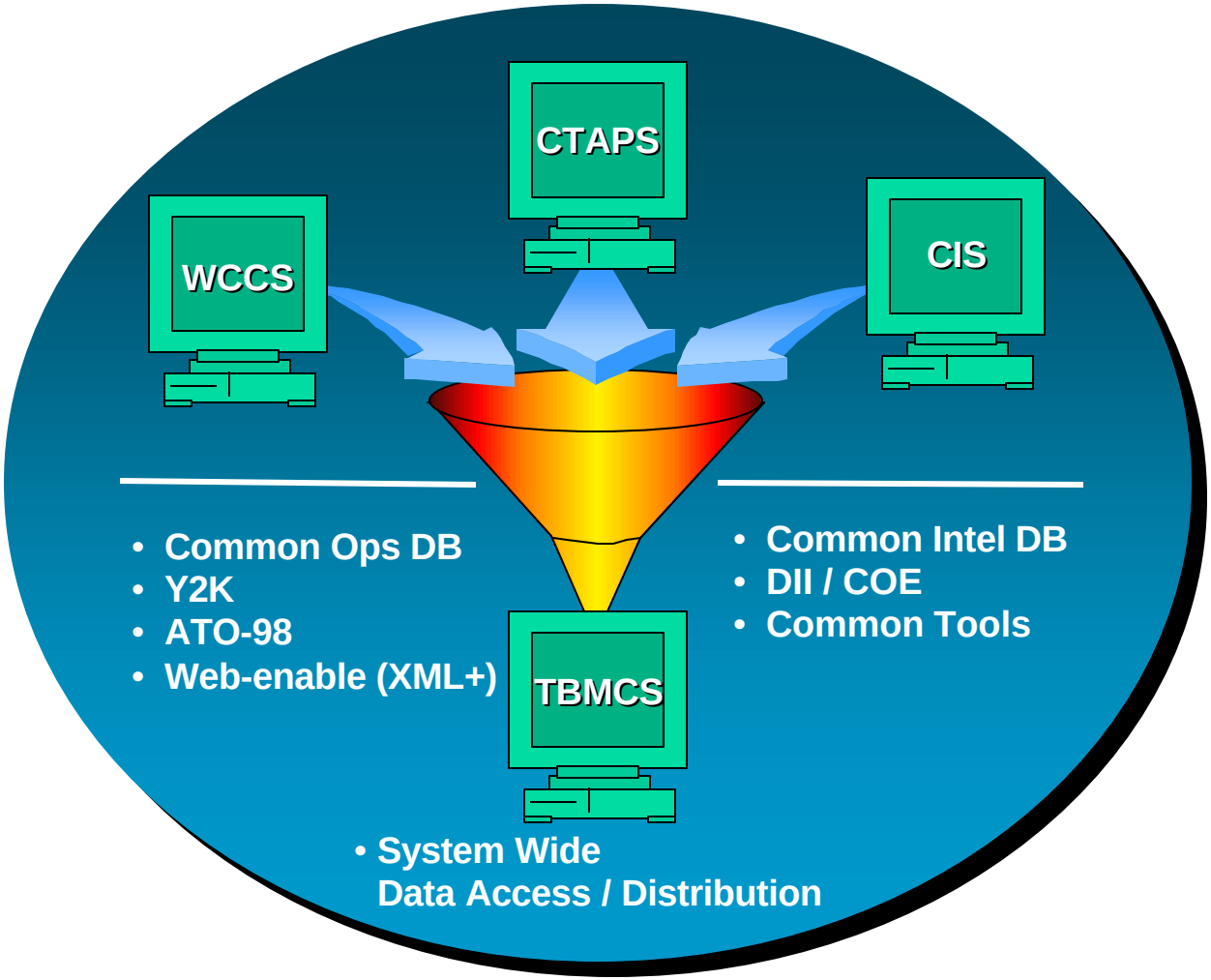
Base wartime manning on:

- ***Full time, fully trained "peacetime" staff***
- ***1/3 ARF augmentees***
- ***Other augmentees, as needed, from another AFFOR***

Recommendation – Field & Evolve TBMCS

- **Field and Evolve TBMCS (SAF/AQ, AF/XO)**
- **Web-enable TBMCS as a step toward the JBI (SAF/AQ)**
- **Major upgrades needed soonest: (AQ)**
  - **Incorporate scalability and interoperability**
  - **Install simplified and consistent user interface**
  - **Reduce system administrator workload**
  - **Improve unit-level modules**
- **Merge and Migrate TBMCS to the GCCS-AF (AQ)**
- **Transition to an evolutionary integration process for yearly upgrades to TBMCS (AC2ISRC, ESC)**

TBMCS


CTAPS
WCCS
CIS
TBMCS
• Common Ops DB
• Y2K
• ATO-98
• Web-enable (XML+)
• Common Intel DB
• DII / COE
• Common Tools
• System Wide
Data Access / Distribution

Recommendation - Institutionalize a C2 Evolutionary Integration Process

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- Recognize the need for continuing C2 integration - - Program and budget for the necessary infrastructure. (SAF/AQ, AFMC)
- Adopt an evolutionary integration process for C2 systems as the normal approach. The DISA approach for evolving the GCCS should be the model. (SAF/AQ, AFMC, AC2ISRC) Major elements:
  - Frequent periodic identification of capability improvements needed in the TACCS
  - Initiation of developments where they are required.
  - Establishment of a configuration control, certification, and integration capability
  - Level funding for integration of mission modules (mostly 3400)
  - Operational testing procedures should be adapted to this new process.
- Employ expert IT professionals (IPA?) to augment the team (AQ,XO,SC)

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Evolutionary Integration Cycle for C2 Systems
(the DISA GCCS model)

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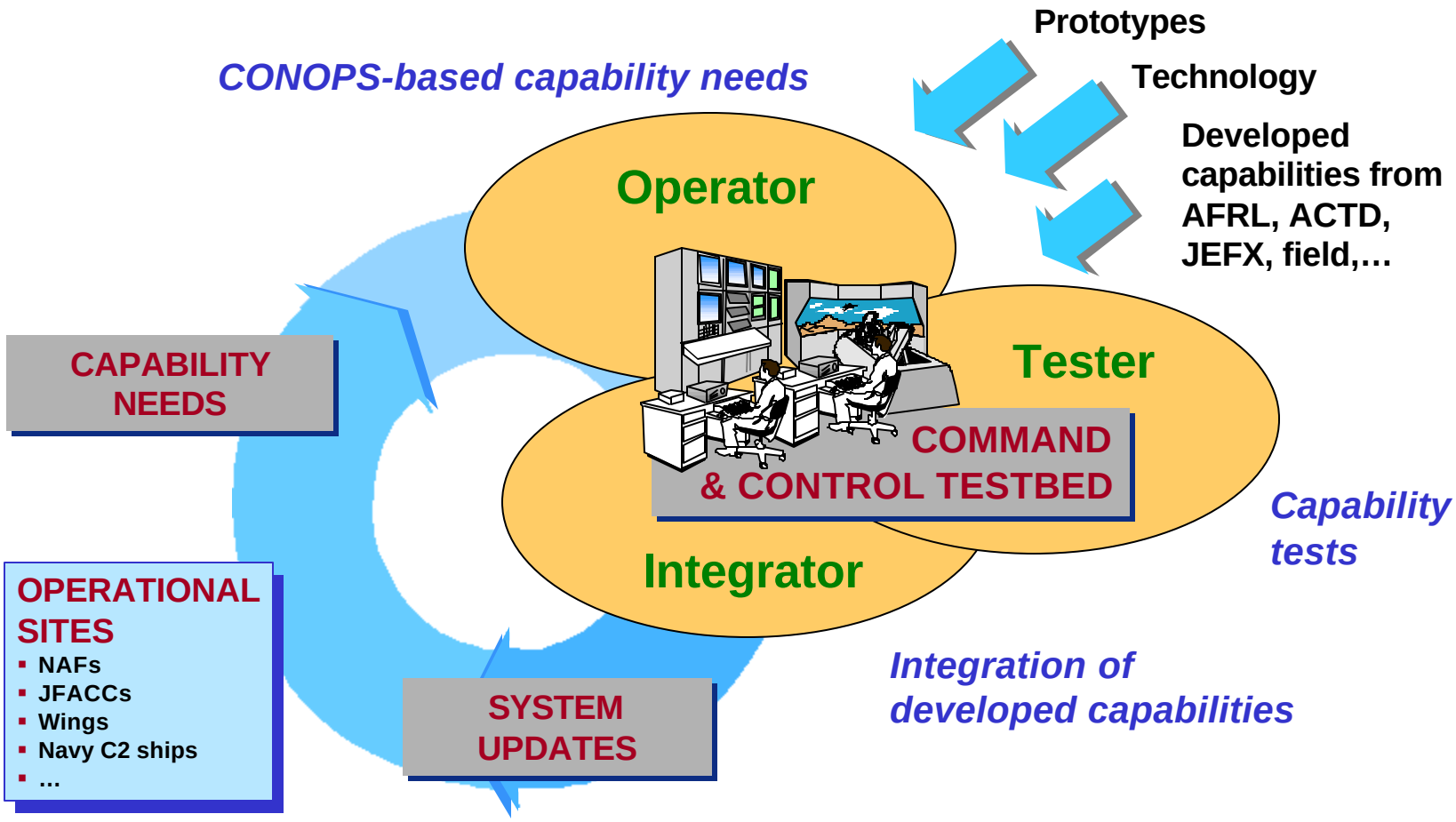

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Evolutionary Integration Responsibilities

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Operator Responsibilities
- Maintain CONOPS & Operational Architecture
- Prioritize desired capabilities
- Operationally evaluate developed capabilities
- Plan, program, and budget for personnel and support
- Foster development of new capabilities (ACTDs, AOCs, etc.)

Developer Responsibilities
- Respond to CONOPS and other user needs
- Assure technologies available for integration
- Participate in ACTDs, JEFXs, Battlelab activities
- Conduct spiral developments as needed

Integrator Responsibilities
- Maintain System and Technical Architectures
- System configuration control
- Engineering and data assessment, risk analysis
- Integration and testing
- Integration of developed capabilities into the baseline system

Ops Tester Responsibilities
- Participate in engineering process
- Do main evaluation during development
- Certify performance post-integration

+ trainers, sustainers, etc.

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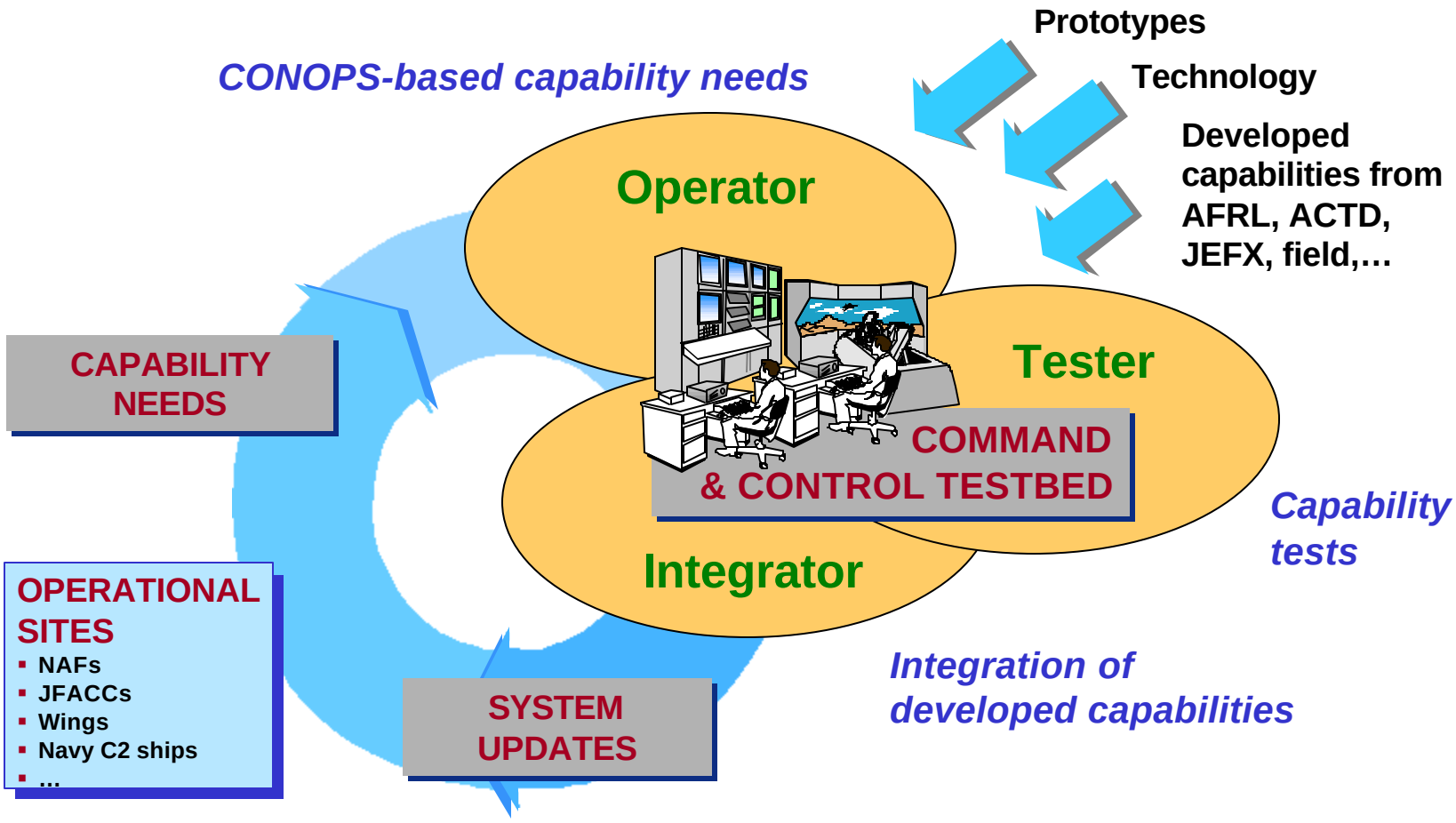

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  - Establishment of a configuration control, certification, and integration capability
  - Level funding for integration of mission modules (mostly 3400)
  - Operational testing procedures should be adapted to this new process.
- Develop a C2 Testbed (AOC-X?) that is based on an integrated team of operators, developers, integrators, testers, sustainers and trainers
- Employ expert IT professionals (IPA?) to augment the team (AQ,XO,SC)

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Harvesting Technologies for C2 Dominance

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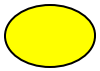
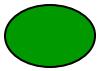
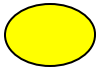
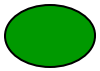
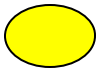
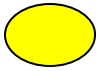
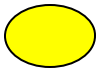
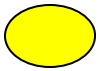
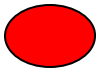
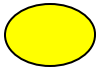
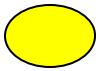
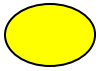
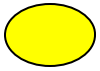
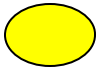
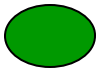
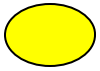
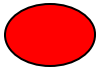
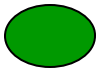
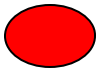
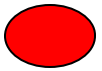
	COTS Available	GOTS Available	C2 Exploitation
Dynamic Planning and Execution			
Connected, Survivable, Reliable Communications			
Information Fusion			
Information Assurance			
Information Management			
Human-Machine Interaction			
Enterprise Systems Engineering			

Green: Some Ready **Yellow**: Future Potential **Red**: Not Yet

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Recommendation: Enable and Encourage Rapid Technology Insertion

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- CONOPS and desired capabilities should drive development, rather than multi-volume requirements documents
- SBIR (6.5) investments should be linked to a master C2 R&D plan
- Fund and facilitate rapid transition of S&T, SBIR, and JEFX developments into weapons systems
- Adopt a formal process to allow operational optimization of C2 information applications, while maintaining configuration control and system integrity
- The DII COE certification process must be streamlined to accommodate new technology (e.g. publish, subscribe, fuselets) in a timely manner.
- Provide authority to all C2 programs to accept industry logo compliance as equivalent to DII COE certification (Level 5)
- Encourage the IT-Operator blue suiters to innovate, and give them the tools to do so effectively

(SAF/AQ)

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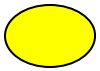
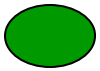
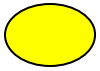
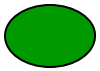
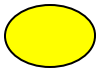
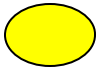
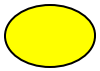
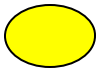
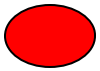
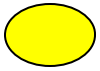
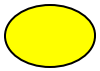
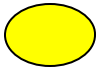
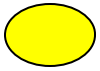
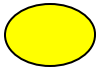
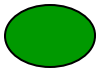
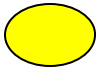
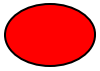
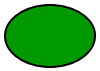
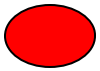
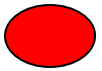
	COTS Available	GOTS Available	C2 Exploitation
Dynamic Planning and Execution			
Connected, Survivable, Reliable Communications			
Information Fusion			
Information Assurance			
Information Management			
Human-Machine Interaction			
Enterprise Systems Engineering			

Green: Some Ready **Yellow**: Future Potential **Red**: Not Yet

Interoperability Happens in Layers

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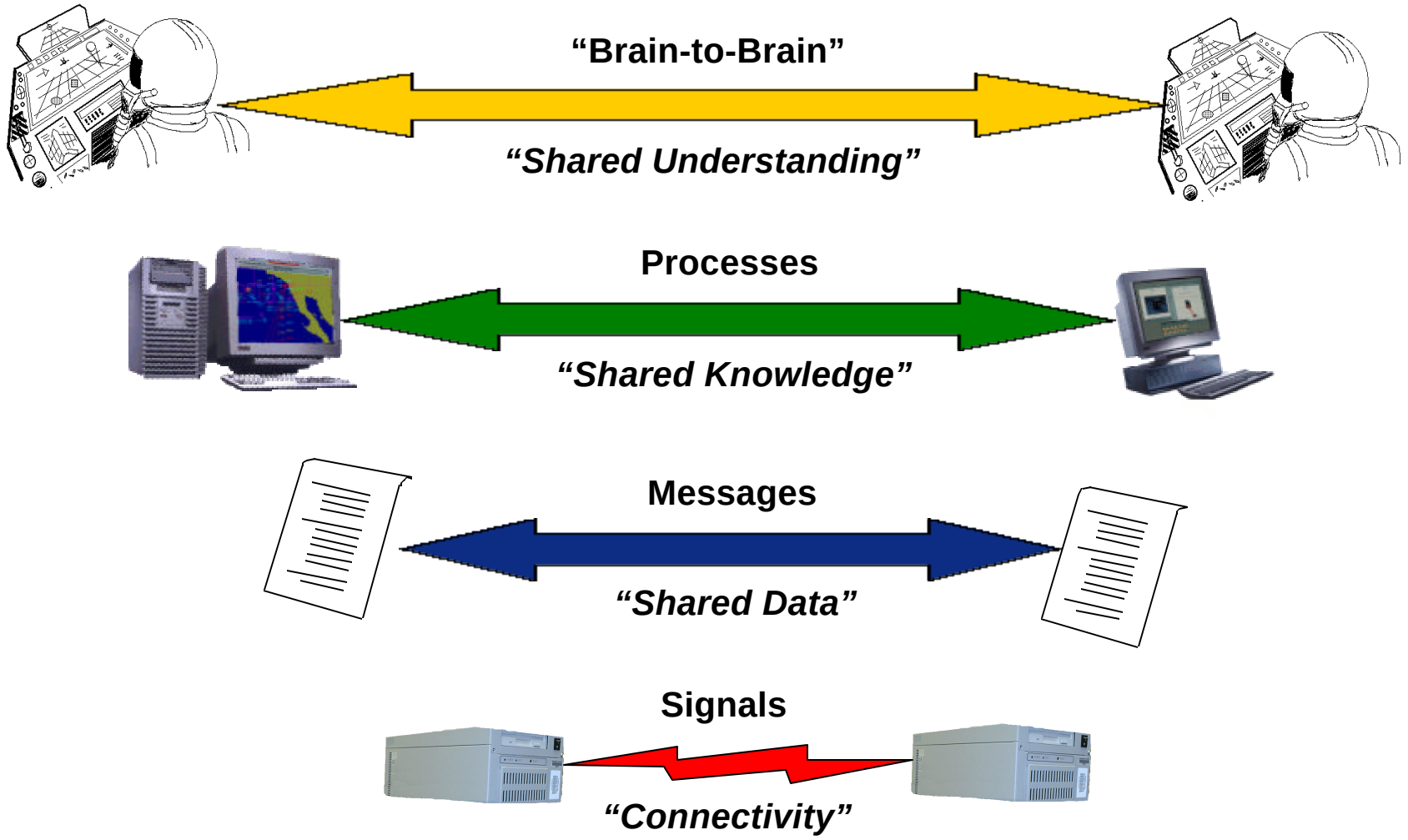

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Recommendation: Achieve Information Interoperability For Warfighters Through JBI

- **Start a process to get databases, systems and people sharing information on a service, joint and coalition basis**
  - **Migrate TBMCS, JMPS, DCAPES, etc. to a common information model – first step is to web-enable & XML-enable (AQ,SC)**
  - **Start defining/refining the information model that the JBI needs (AQ,XO,SC)**
  - **Take the lead in encouraging the movement of the DII COE to an internet-like, services-oriented concept (AQ,SC)**
  - **Push the Adaptive Battlespace Awareness ACTD & use it as a vehicle to do all this, plus becoming the heart of a real C2 test bed (AQ,XO,SC)**
  - **Establish a process to assure effective Human-System Integration**
- **Get J-6, OASD/C3I (DISA), Army & Navy involved – CECOM & SPAWAR are ready to work with us (AQ,SC)**

JBI: The Key To Interoperability

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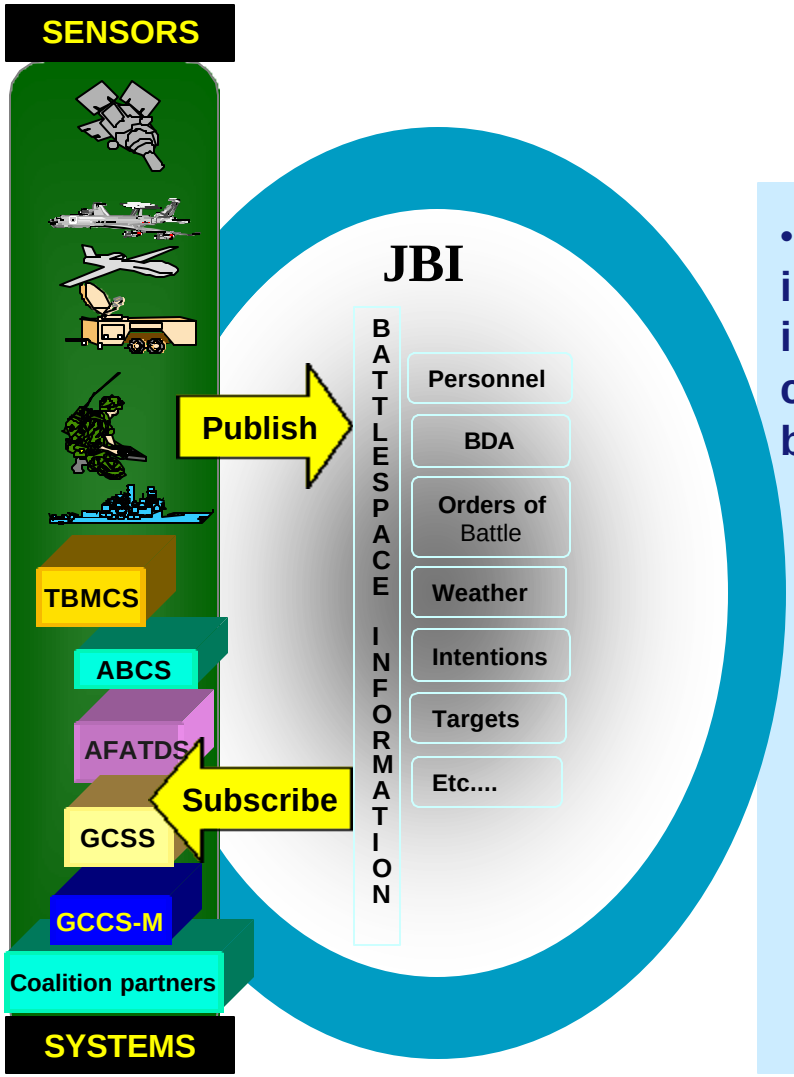

- **The JBI is a system of systems that integrates, aggregates, and distributes information to users at all echelons, from the command center to the battlefield. The JBI is built on four key technologies:**
  - Information exchange
    - Publish/Subscribe
  - Transforming data to knowledge
    - Fuselets
  - Distributed collaboration
    - Shared, updatable knowledge objects
  - Force/Unit interfaces
    - Templates
      - Operational capability
      - Information inputs
      - Information requirements

Warfighter Career Track

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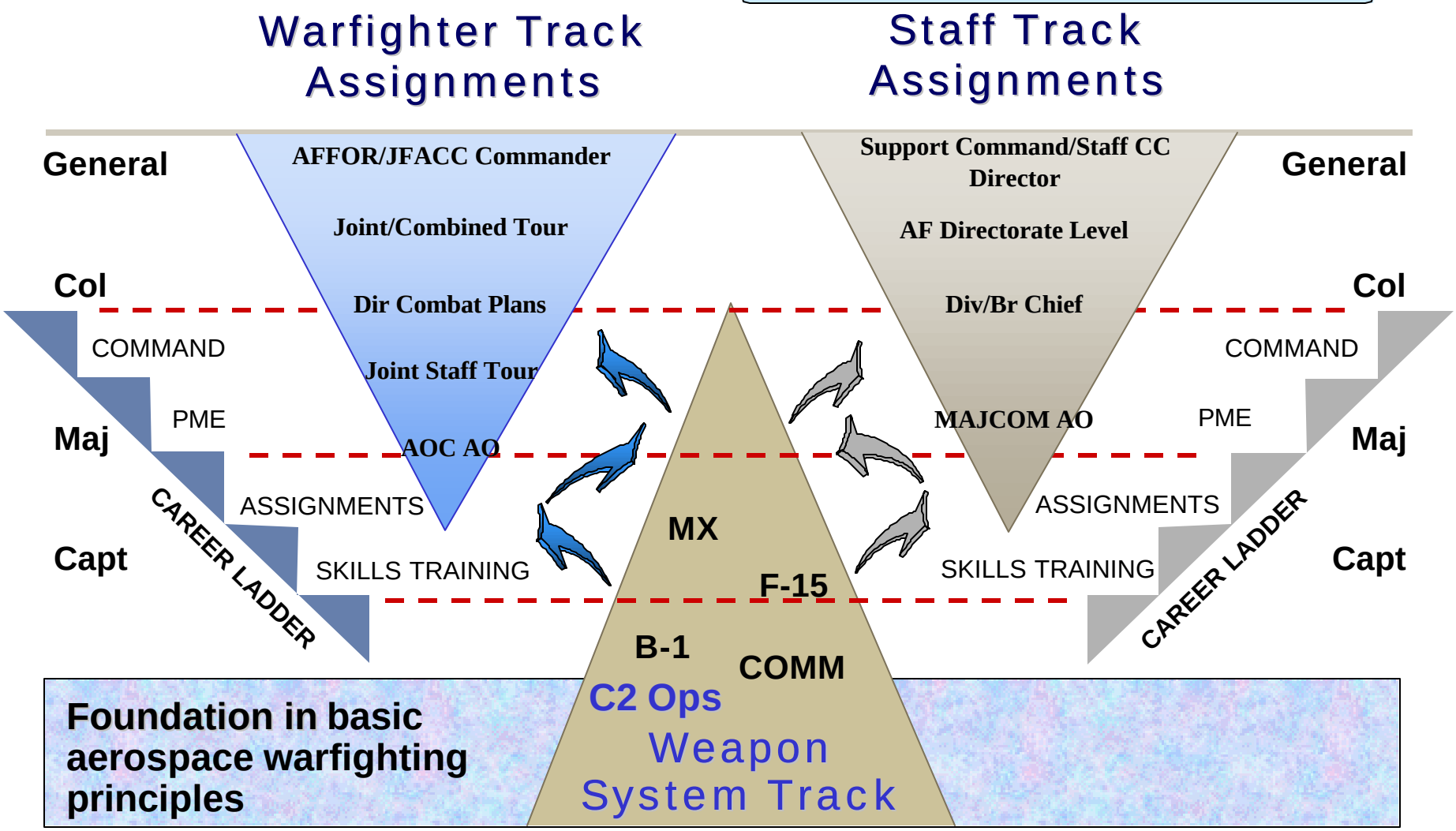

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Recommendation: Staff and Train To Be Consistent With The Importance of C2

SAB 2000: Air Force C2~The Path Ahead

- **Model C2 Training after conventional weapon system training programs**
  - **Derive training requirements and standards from CONOPS/METLs**
  - **Establish "Standing AOC" with peacetime ops. & training mission**
  - **Actively engage AOCs in training, exercises and AEF spin-up cycle**
  - **Apply Distributed Mission Training (DMT) to integrate AOC, WOC & SOC**
  - **Ensure compliance with existing C2 training directives**
- **Elevate the stature and advancement opportunities for C2 warriors**
  - **Develop professional CAF C2 cadre and career track**
  - **Establish C2 skill & staffing requirements based on CONOPS**
  - **Assign AFSC/SEI codes for C2 specialists and improve tracking system**
  - **Recognize and promote to recognize C2 expertise**
- **Initiate a program to capture the exodus of IT-Ops professionals in specialized ANG and AF Reserve units for continuing support to AF C2**

(AF/XO)

Warfighter Career Track

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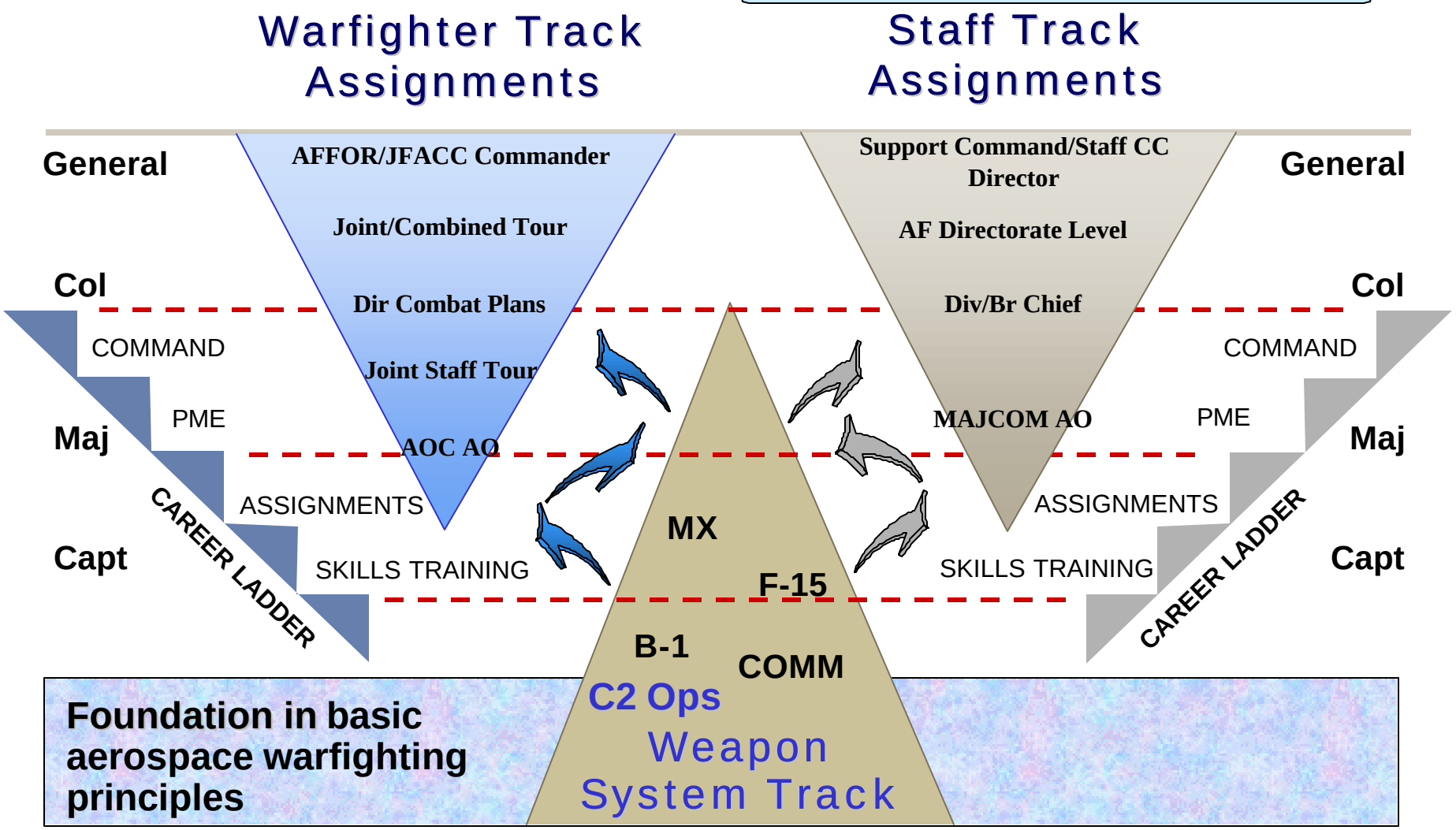

Some Keys For
"Linking The Air Force By 2005"

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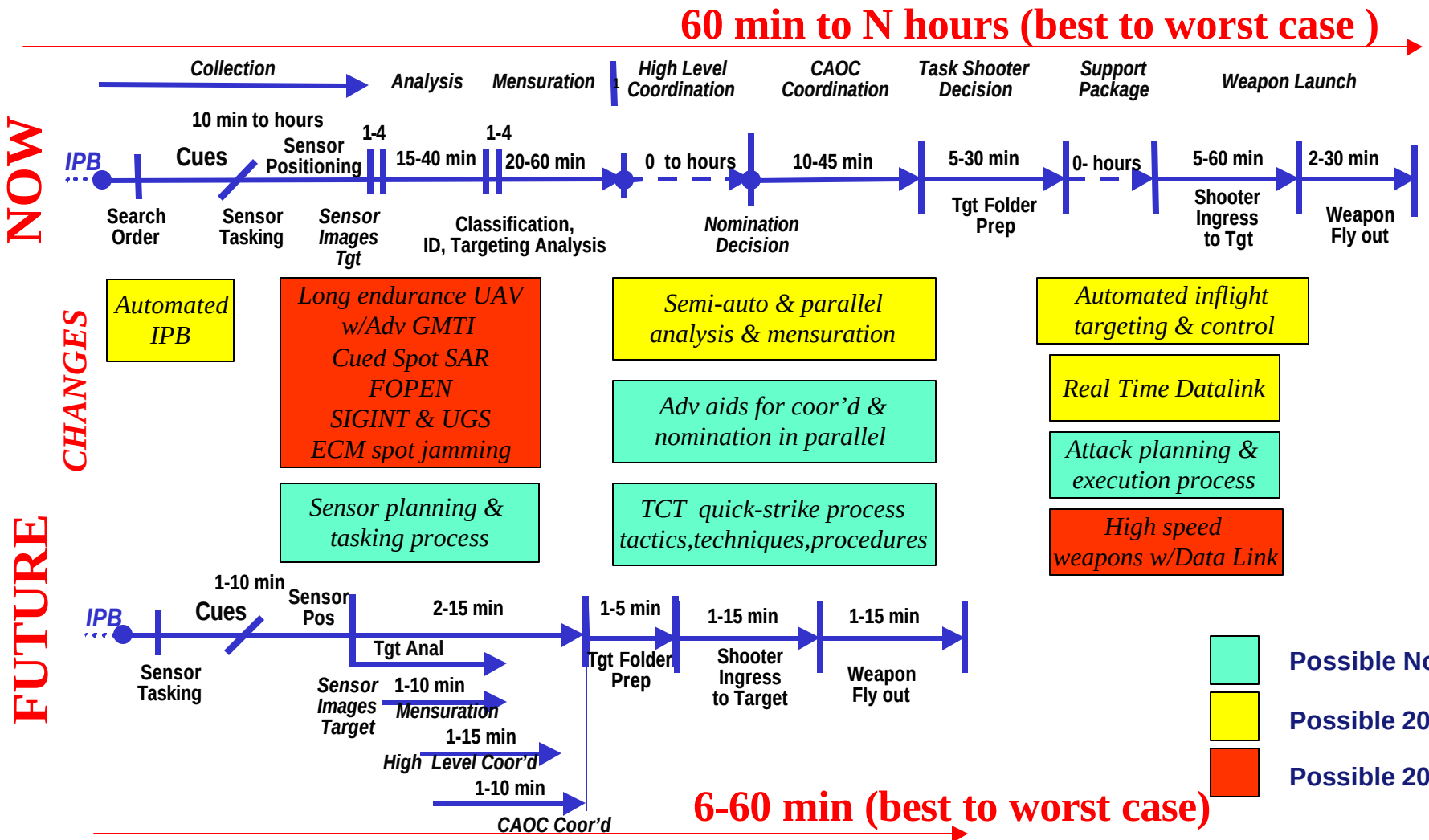
TCT Targeting Timeline

Now and Future

SAB 2000: Air Force C2~The Path Ahead



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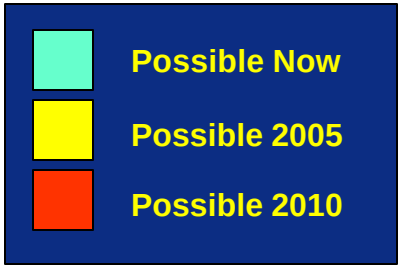
Recommendation: Strengthen Efforts For Attack of Time Critical Targets

SAB 2000: Air Force C2~The Path Ahead

Initiate a program team to address the rapid response attack of time critical targets. Include:

- **Automated IPB**
- **Continuous high altitude long endurance UAV w/ advanced GMTI and spot ultra high resolution (UHR++) SAR/EO/IR imagery**
- **Rapid semi-automatic analysis of cued (UHR++) spot imagery**
- **Improved sensor planning and tasking processes**
- **Automated mensuration w/ digital reference foundation database**
- **Parallel processes where possible with approx location analysis, mensuration, coordination, nomination**
- **Automated in-flight targeting/re-targeting**
- **Secure data link to the aircraft**
- **TCT Cell for critical mobile targets**
- **Develop high-speed weapons**



(SAF/AQ, XO, XP, SC)

TCT Targeting Timeline

Now and Future

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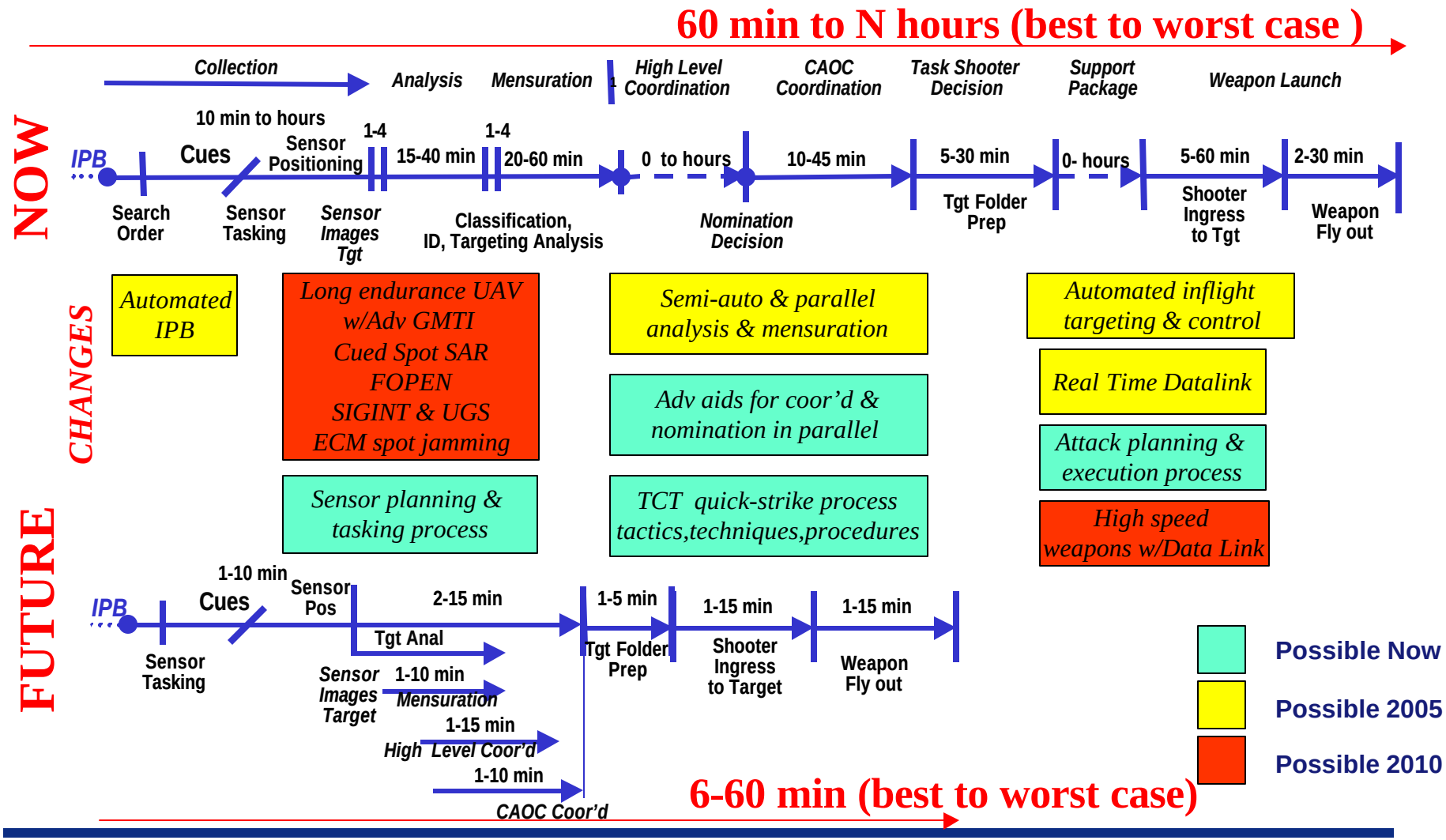
SAB 2000: Air Force C2~The Path Ahead



U.S. AIR FORCE

Why We Don't Have Datalinks

- **Total programmed Link 16 investment between FY00 and FY07 is $610M divided between 19 PEs.**

- **Air Staff: 3 Panels working the investment: Information Superiority, Air Superiority, Global Attack**

- **19 Programs: F-15, F-16, F-22, B-1, JSF, B52, A-10, AWACS, JSTARS, ABCCC, Rivet Joint, Cobra Ball, ABL, GTACS, ASOC, TACP, JINTACCS, JTIDS, Network Design/Training.**

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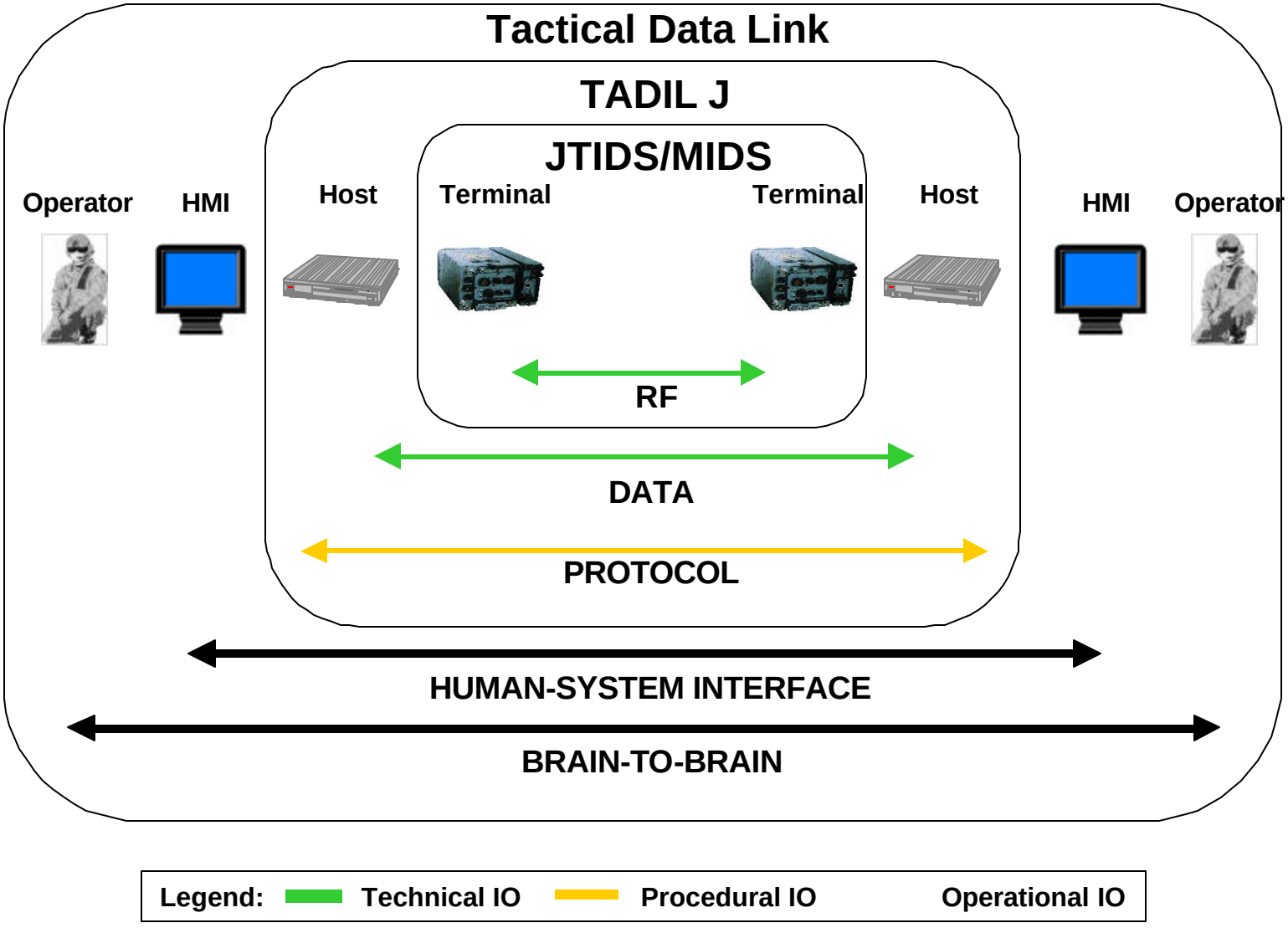
Recommendation: Facilitate/Enhance Data Connectivity

- **Designate an Air Staff office as the single control point for cross-platform C2 capability funding and select an execution organization (AFMC) (SAF/AQ,XO,SC)**
  - **Examine interim alternative options in detail for SADL, IDM, Link-16/SADL/ IDM with Gateways (i.e., Talon Gateway), and other innovative solutions**
  - **Explore operational alternatives capitalizing on partial equippage**
  - **Develop required infrastructure support (network management, message management, testing, training, etc.)**
  - **Prioritize the investments to deploy AEFs with encrypted data-enabled capability**
- **Address need for robust, affordable, beyond line-of-sight links to airborne platforms – low and high data rates (XO,SC)**
- **Investigate and address other data connectivity issues and solutions (SC)**
- **Review quarterly at QAPRs?**

Levels of Interoperability



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Focus on the most cost-effective operational capability soonest

SADL Option for F-16 Blk 40/50

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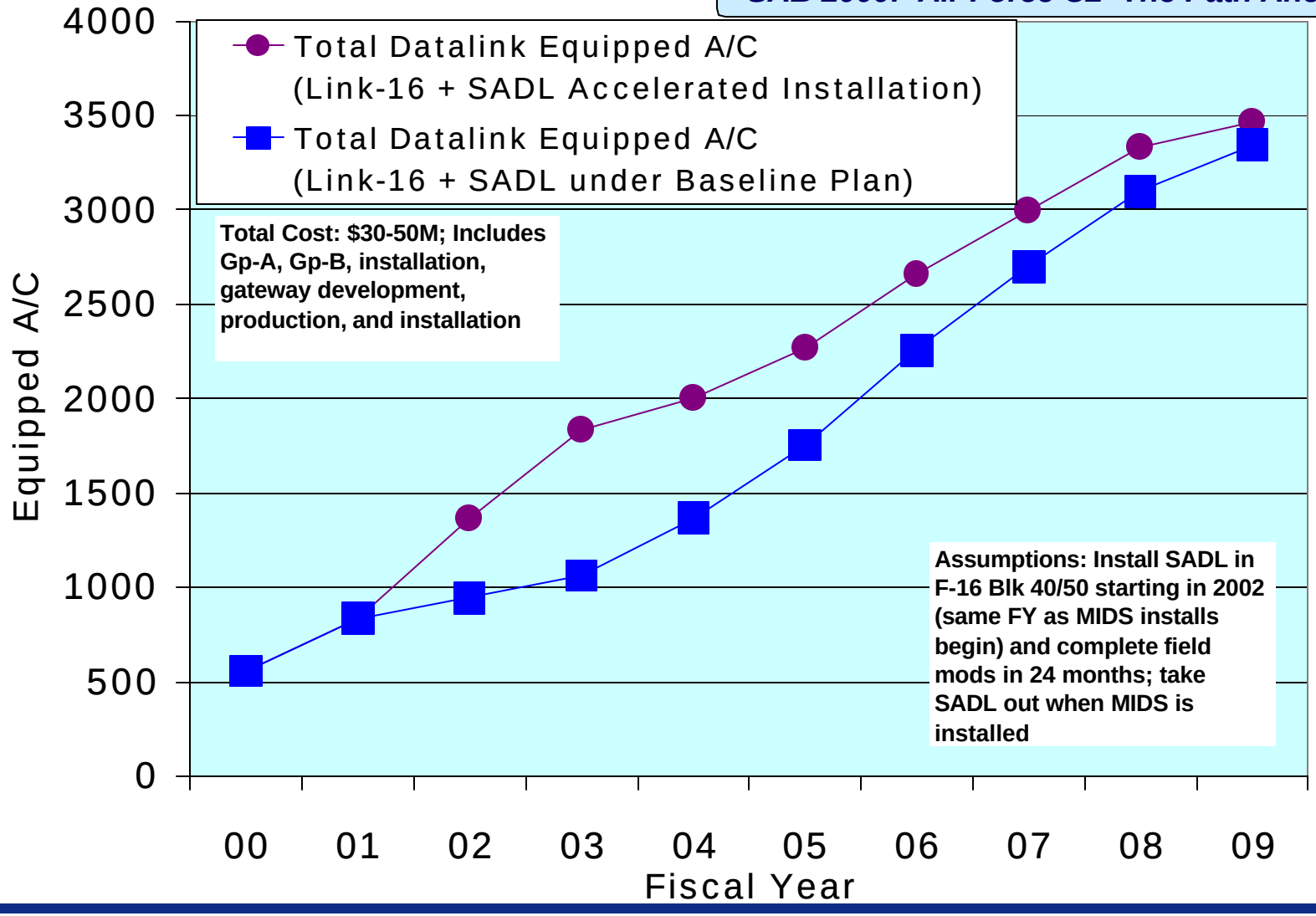

Recommended CSAF Actions

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- Establish single C2ISR manager at AF level (e.g., 3 star Operator) – AF Council Member
- Integrate expert IT professionals into the C2 staff
- Direct a C2 Program restructure
- Adopt the GCCS framework: Evolve Theater AF C2 applications into GCCS-AF
- Direct a capability-centric Evolutionary Integration Process for C2
- Manage theater aerospace C2 as a system of "weapon systems"
- Baseline the number, configuration, and location of AOCs. Enhance operation and reduce personnel through daily "wartime" use
- Appoint a "lead dog" for agile combat support software systems (GCSS-AF)

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The Foundation For Effective Air Combat is Command and Control

SAB 2000: Air Force C2~The Path Ahead

Establish the "Theater Command and Control 2000 Initiative"

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The Vision

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